ABSTRACT

Brick masonry has been used for the construction of walls in buildings since prehistoric times Although India is one of the largest producers of bricks this material and its application have not received much attention with reference to the engineering properties This thesis attempts to study the various properties of bricks mortars and brick masonry with reference to the locally available bricks

The first chapter summarizes the historical development of brick masonry in India A literature review about the studies on bricks, mortars and brick masonry has also been reported The objectives and scope of the study is highlighted

The second chapter deals with the characterization of properties of bricks and mortars Various properties viz compressive strength water absorption initial rate of absorption soaking duration and elastic modulus of bricks from different regions of India have been studied The study decidedly confirms that the table moulded bricks of Northern regions of India are relatively stronger and stiffer as compared to the table moulded bricks of Southern regions However the wire-cut bricks of Southern regions have properties comparable to the table moulded bricks of Northern India A comparison of properties of seven different types of mortars has also been carried out It is observed that the conventional 1 6 cement mortar has an elastic modulus much higher than the modulus of a majority of the bricks available in this country However it is also seen that the strength and modulus of such mortars can be altered by the addition of adequate amounts of lime/soil as an additional ingredient

Chapter three deals with the study of the behaviour of short masonry specimens under compression using moderate/high strength bricks and various mortars In case of table moulded brick masonry although the stack bonded prisms are generally found to be stronger than the English bonded prisms (with a few exceptions) the difference varies over a wide range of 14 –70% The stack bond and English bond prisms exhibit masonry efficiencies in the range of 20 - 31% and 17 – 23% respectively for various mortars Prisms and wallettes with stronger mortar fail due to splitting of bricks whereas in case of weaker mortars the failure is due to loss of brick-mortar bond Because of high coefficient of variation (40%) in the brick strength, the crushing of the weakest brick is often observed during the compression tests on the brick masonry specimens Thus the masonry

strength appears to be controlled by the weakest brick in the specimen rather than the brick-mortar interaction, especially when the coefficient of variation in the brick strength is high The scatter in the strength values of wallettes is relatively less than in case of prisms which suggests that testing of wallettes is more reliable and would thus help in predicting the masonry strength with greater level of confidence However it is also felt that more number of specimens may have to be tested for each combination to arrive at a representative value of the masonry strength Table moulded brick specimens exhibit secant modulus values in the range of 262 - 735MPa

The wire-cut brick specimens show good correlation between mortar strength and masonry strength Higher masonry efficiencies in the range of 27 - 53% were observed in these prisms/wallettes The wire-cut brick masonry specimens exhibit lesser scatter in the strength values as compared to the table moulded brick specimens but also again show lesser scatter in the wallette strength than the prism strength The wire-cut brick specimens using various mortars exhibit relatively higher secant moduli values in the range of 2393 - 5232MPa

Chapter four mainly discusses the flexural bond strength of masonry using two different type bricks and seven types of mortars It is observed that use of composite mortars enhances the bond strength of masonry The study also shows that with the use of 1 6 cement mortar generally leads to low values of flexural bond strength of brick masonry irrespective of the brick strength An attempt has also been made to obtain a correlation between flexural bond strength and compressive strength of masonry

Tests on three full-scale brick masonry walls under axial compression using table moulded and wire-cut bricks have been presented in chapter five Two of the walls are half brick thick using table moulded and wire-cut bricks The other wall is one brick thick in English bond The failure loads failure patterns and the elastic properties of the three walls have been reported The permissible stresses as per IS 1905 - 1987 have been compared with the failure stresses from the experiments to understand the implications of the reduction factor due to slenderness ratio The factor of safety of such walls is also reported

The thesis concludes with chapter six summarizing the results of the study with suggestions for further scope of research